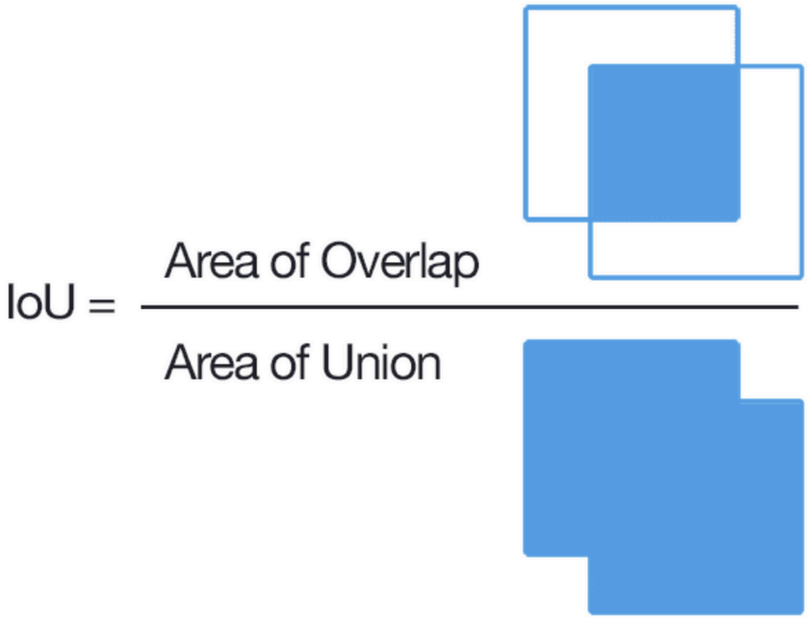
Evaluation Metrics

Intersection over Union (IoU)

- Intersection over Union (IoU) is a metric used to evaluate the accuracy of object detection models, such as object localization and image segmentation.
- It measures the overlap between two bounding boxes: the predicted bounding box and the ground truth bounding box.
- An IoU threshold (e.g., 0.5) is often set to determine if a predicted bounding box is a true positive or a false positive. If IoU > threshold, the prediction is considered accurate.

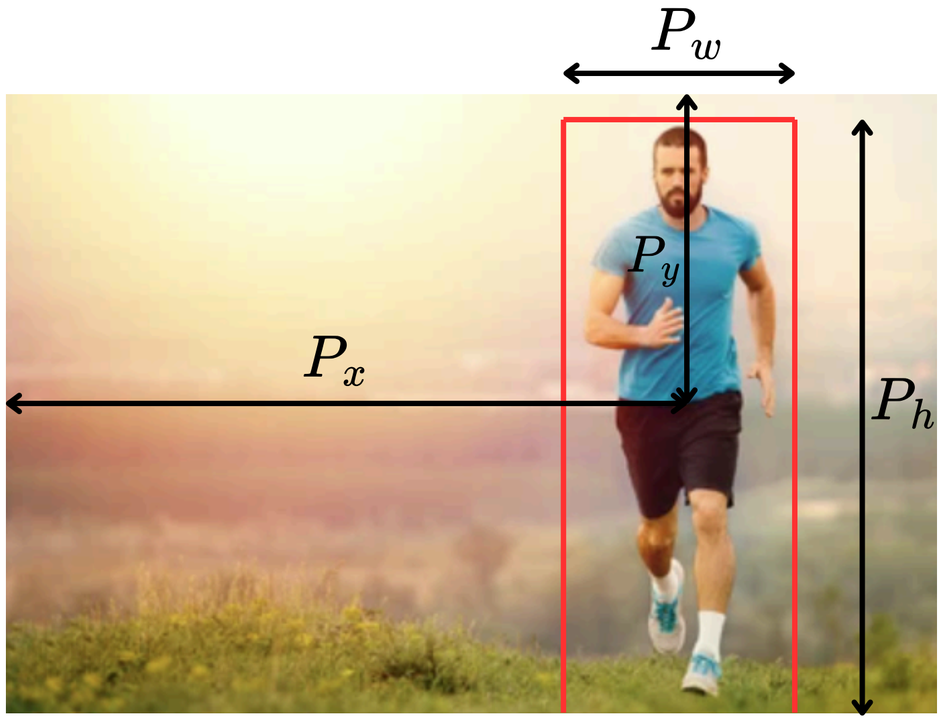
$$IoU = \frac{\text{Area of Overlap}}{\text{Area of Union}}$$



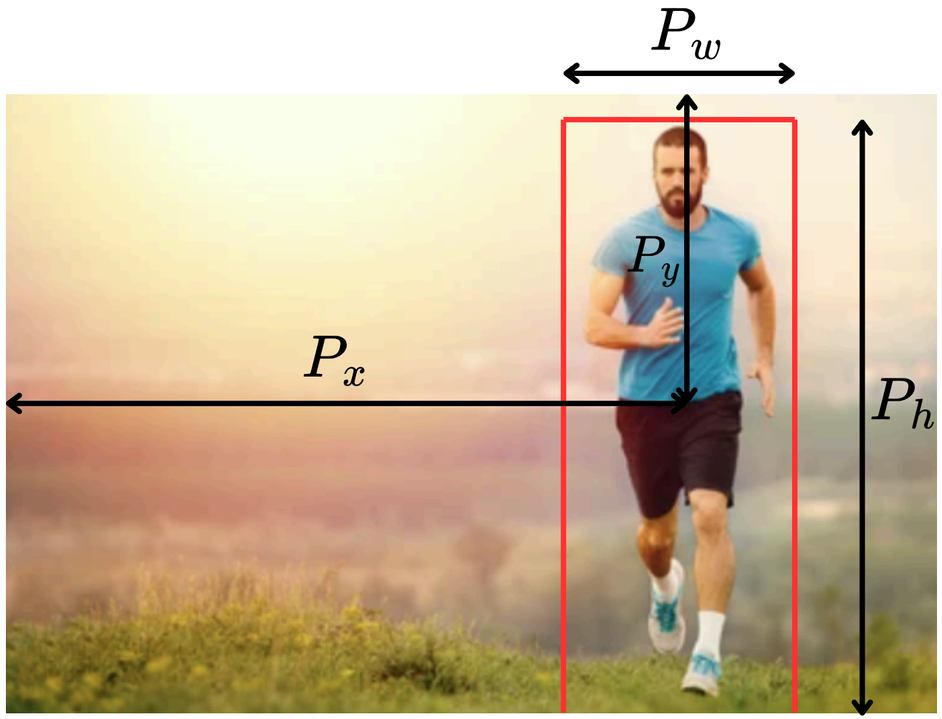
Source

How to represent Bounding Boxes

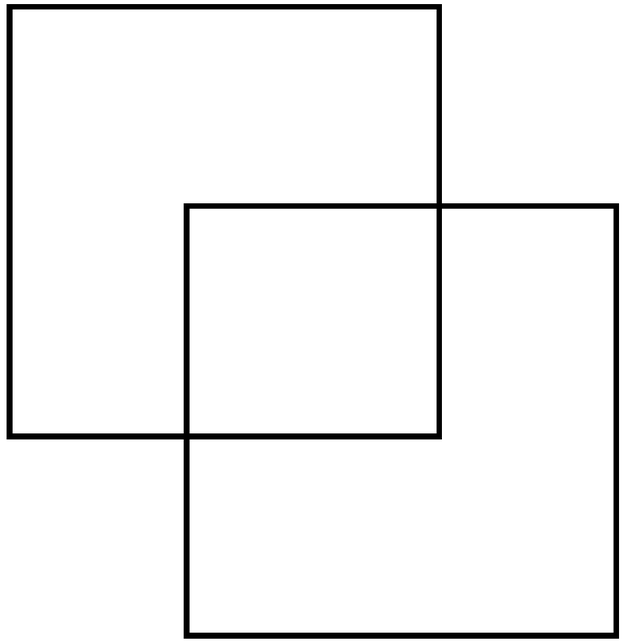
How to represent Bounding Boxes

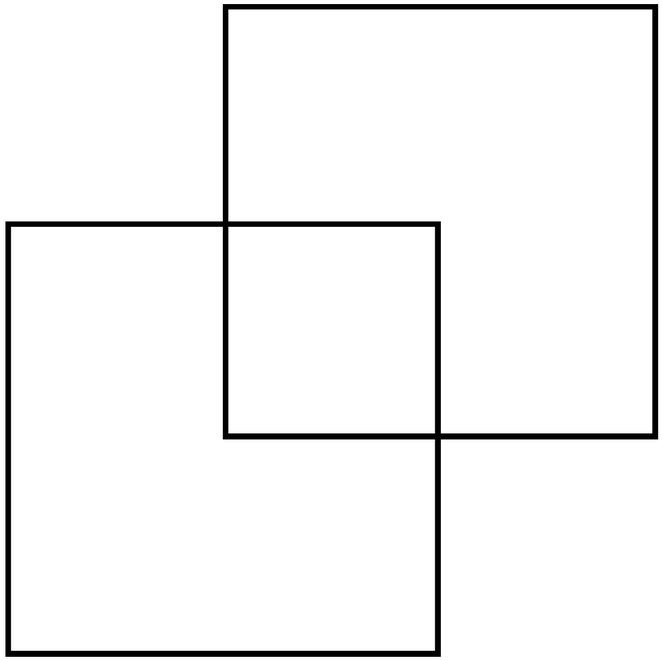


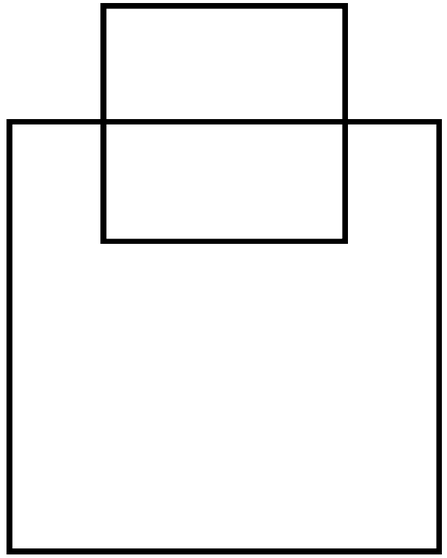
How to represent Bounding Boxes

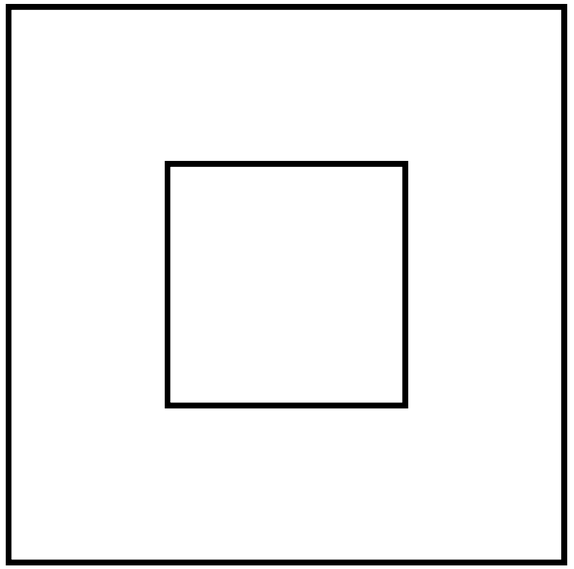


Approach to Calculate IoU?









NMS

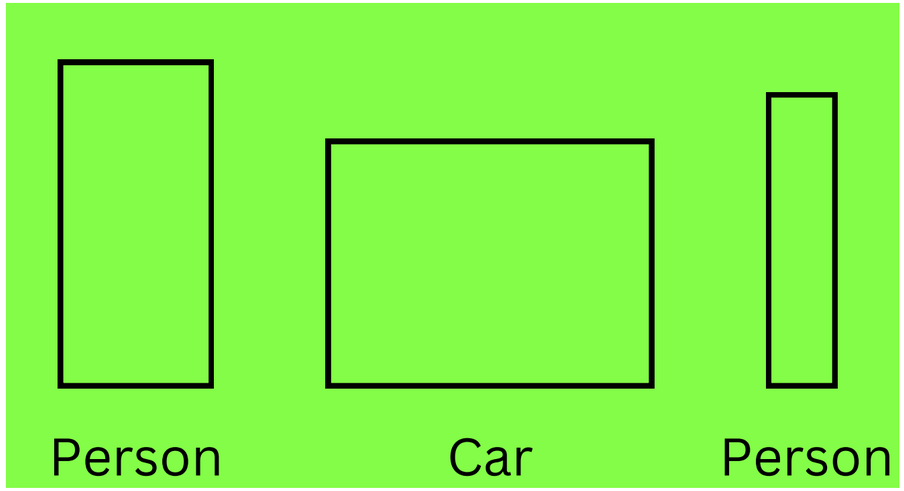
Steps in NMS :-

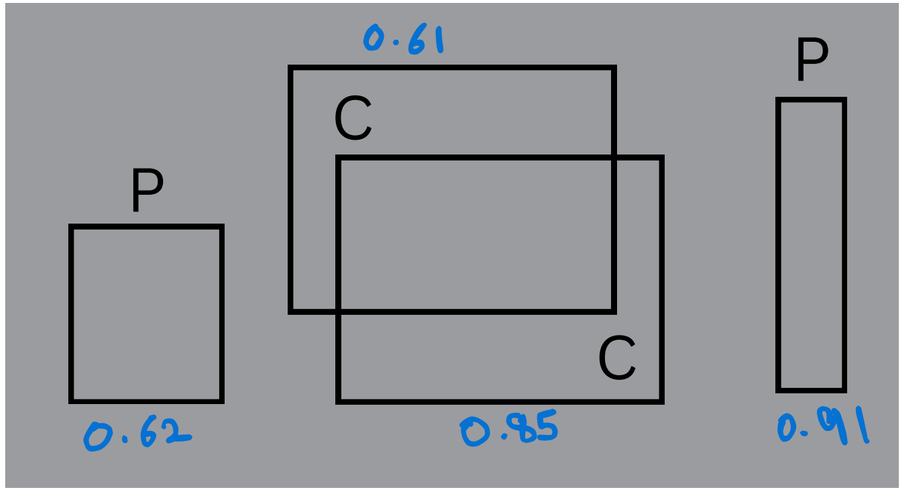
- Filter out bounding boxes that have a confidence score below a certain threshold.
- Sort the remaining bounding boxes based on their confidence scores in descending order.
- Start with the highest-scoring bounding box and select it as the best bounding box.
- Compute the Intersection over Union (IoU) of the selected box with all other boxes and remove (suppress) all boxes that have an IoU greater than a predefined threshold (e.g., 0.5) with the selected box. These boxes are considered redundant because they overlap significantly with the selected box.
- Repeat the process with the next highest-scoring box from the remaining set of boxes until no more boxes remain.

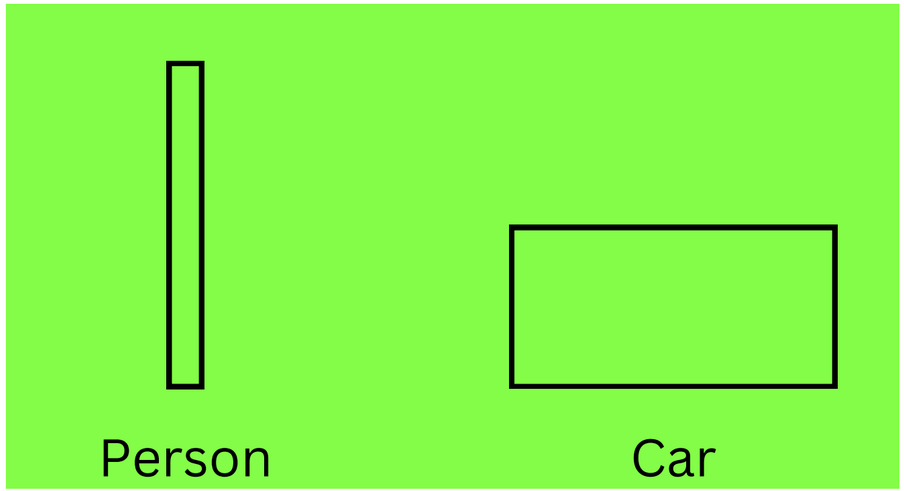
Implement NMS using the IoU function you've just seen

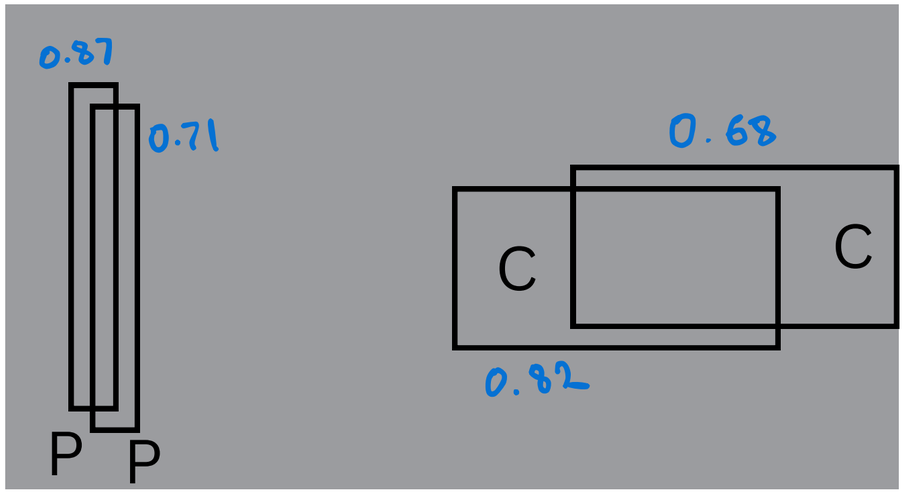
mean Average Precision

- Calculate Average Precision for each class separately and then take the mean over all classes.
- Average Precision is always calculated for a particular IoU threshold.
- Average Precision is the area under the Precision-Recall Curve.
- How to plot the Precision-Recall Curve? Let’s see


Person
Car
Person


0.61
C
P
P
C
0.62
0.85
0.91


Person
Car


0.87
0.71
0.68
C
C
0.82
P
P

Decreasing order of confidence

TP	FP	Cum TP	Cum FP	Precision	Recall
1	0	1	0	1	0.3
1	0	2	0	1	0.6
0	1	2	1	0.6	0.6
0	1	2	2	0.5	0.6

Table made for each class individually

Let's take Person class first

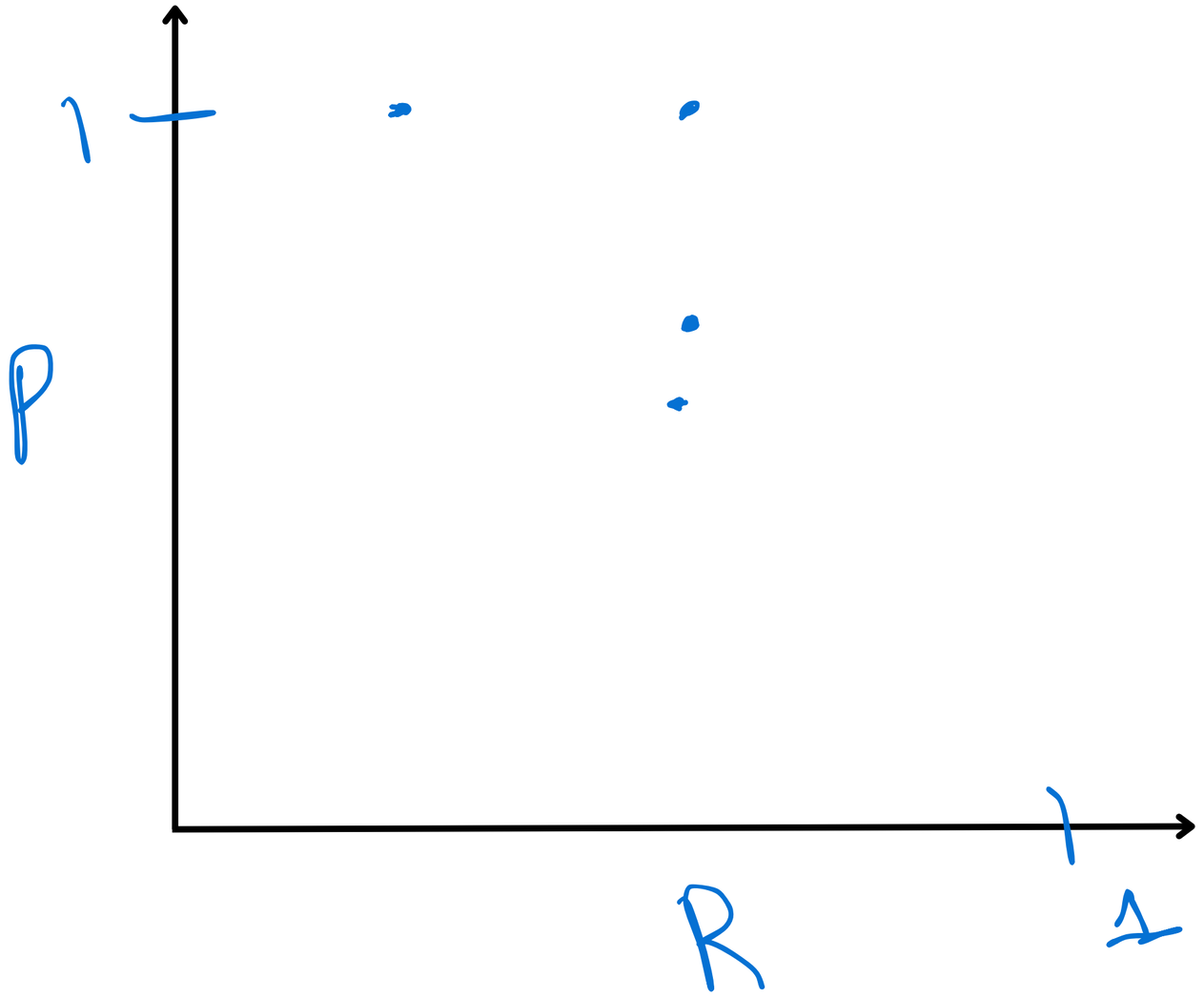
Decreasing order of confidence

TP	FP	Cum TP	Cum FP	Precision	Recall

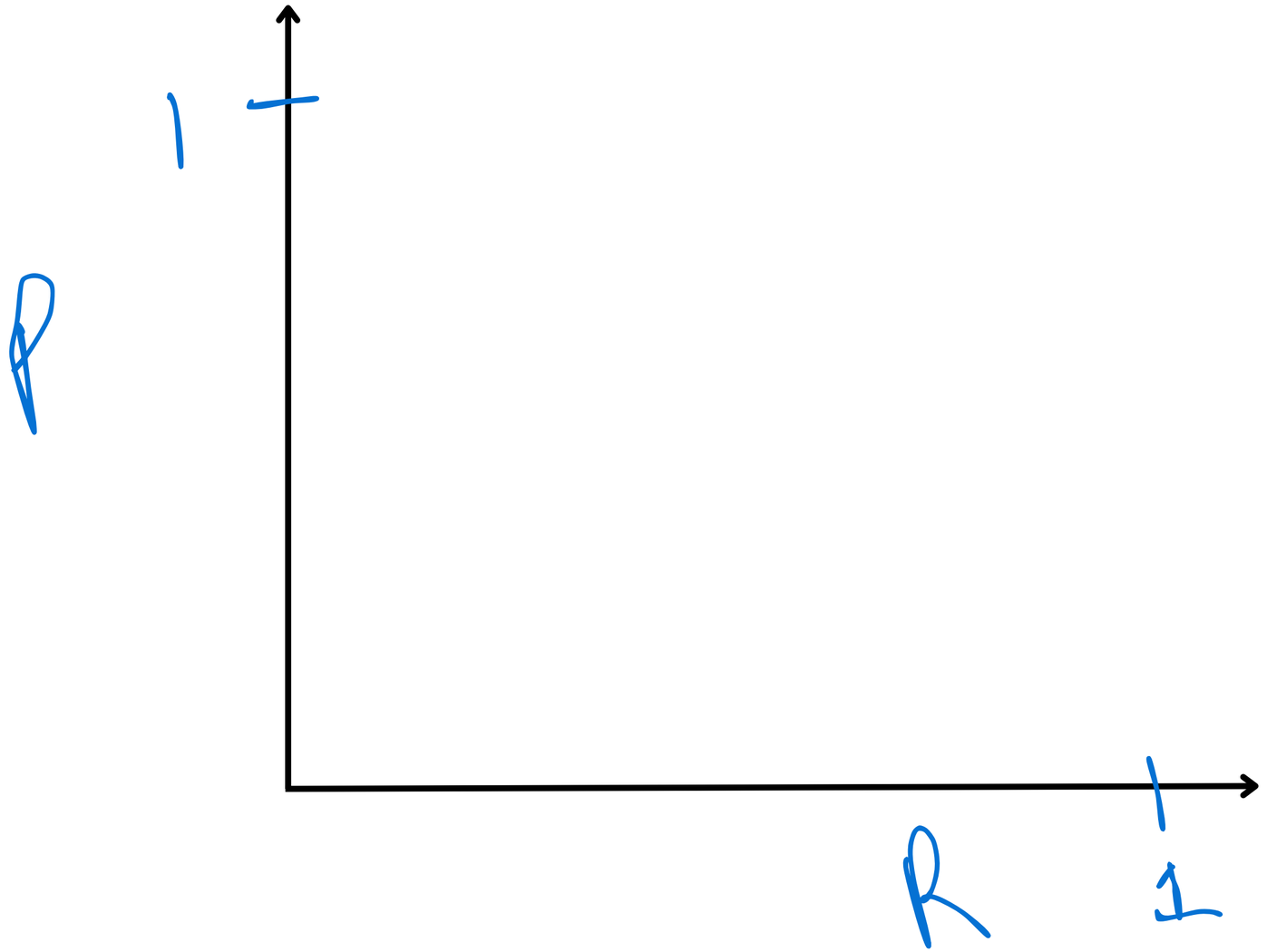
Table made for each class individually

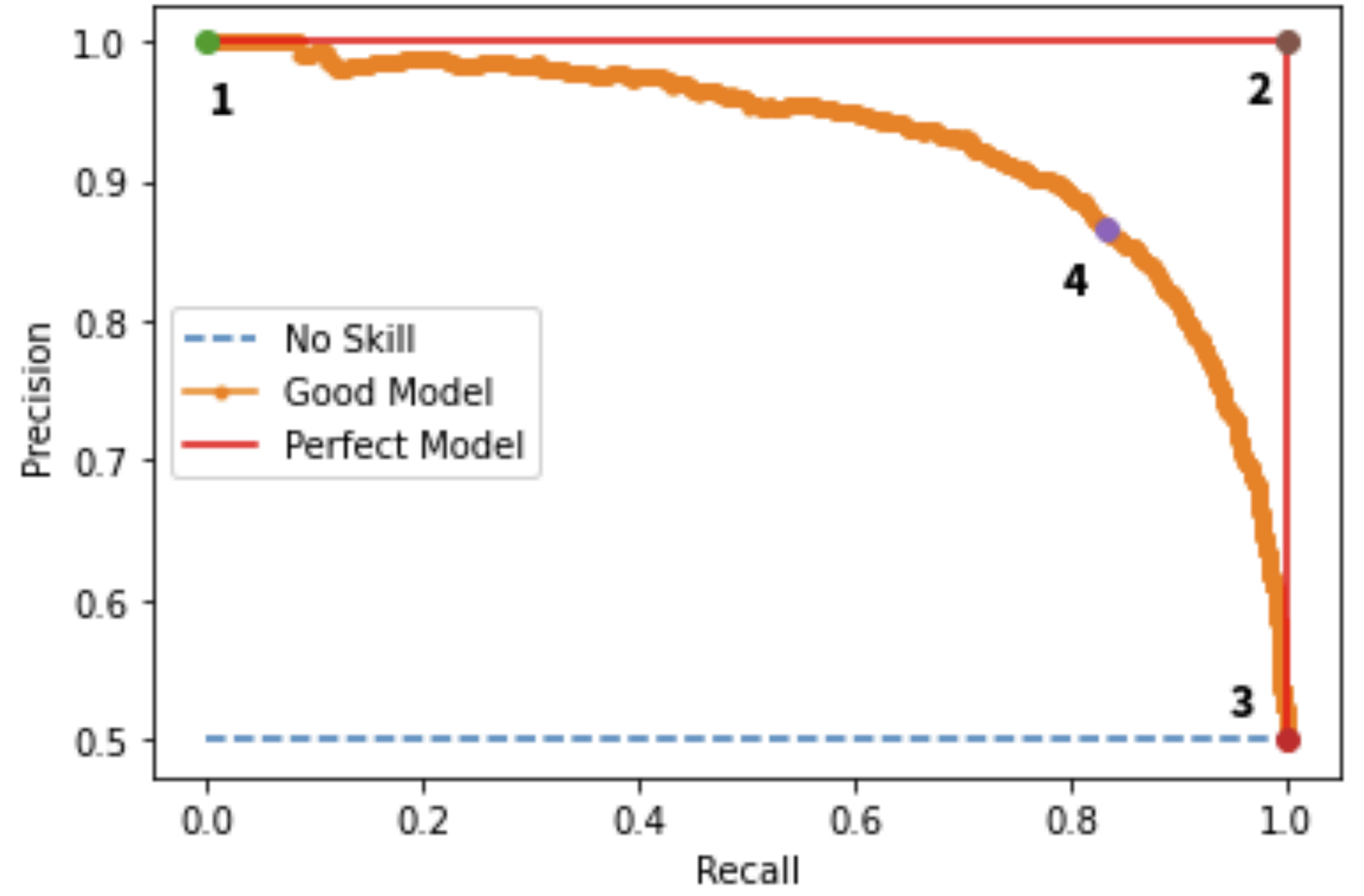
Car Class

Person



Car




1.0
0.9
0.8
0.7
0.6
0.5
Precision
0.0
0.2
0.4
0.6
0.8
1.0
Recall
No Skill
Good Model
Perfect Model
1
2
3
4

mAP at 0.5 = [AP(Person) + AP(Car)]/2